2008 FOURTH QUARTER AND ANNUAL REPORT

Groundwater, Stormwater, and Landfill Gas Monitoring
Closed Leichner Brothers Landfill
Vancouver, Washington

Shaw Project No. 125544

February 2009

Submitted to:

Leichner Brothers Land Reclamation Corp.
Vancouver, Washington

Submitted by:

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The material and data in this report were prepared under the supervision and direction of the undersigned.

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Acronyms and Abbreviations

CAS	Columbia Analytical Services, Inc.
CMP	compliance monitoring plan
Cl	chloride
DMR	discharge monitoring report
Ecology	Washington State Department of Ecology
Fe	iron
GCCS	landfill gas collection and control system
LBLRC	Leichner Brothers Land Reclamation Corporation
LBLF	Leichner Brothers Landfill
LFG	landfill gas
MEK	2-butanone (methyl ethyl ketone)
MFS	(Washington) Minimal Functional Standards
mg/L	milligrams per liter
Mn	manganese
MTCA	Model Toxics Control Act
NPDES	national pollutant discharge elimination system
QA/QC	quality assurance/quality control
Shaw	Shaw Environmental, Inc.
SWCAA	Southwest Clean Air Agency
TDS	total dissolved solids
UCL	upper confidence limit
µg/L	micrograms per liter
VOC	volatile organic compound
WAC	Washington Administrative Code
WBZ	water bearing zone

1.0 Introduction

This 2008 fourth quarter and annual report presents the results of routine groundwater, stormwater, and landfill gas (LFG) monitoring performed during 2008 at the closed Leichner Brothers Landfill (LBLF), located 5 miles northeast of Vancouver, Washington (Figure 1-1). Shaw Environmental, Inc. (Shaw) performed the monitoring activities and prepared this report on behalf of the Leichner Brothers Land Reclamation Corporation (LBLRC). The monitoring and reporting were performed in accordance with the July 17, 1996, Consent Decree between the Washington State Department of Ecology (Ecology) and the LBLRC, and consistent with Chapter 173-340-410 and -820 Washington Administrative Code (WAC) and the schedule defined in the updated Compliance Monitoring Plan (CMP) (Shaw, 2005a). The Consent Decree included a cleanup action plan, which established groundwater compliance standards.

Groundwater monitoring was performed semiannually (twice a year) in 2008 during the winter (first quarter) in March and summer (third quarter) in September in accordance with the procedures and methods described in the CMP. Columbia Analytical Services, Inc. (CAS) in Kelso, Washington, analyzed the groundwater samples collected from the site monitoring wells in 2008.

During the winter of 2003-2004, LBLRC applied for and received a general National Pollutant Discharge Elimination System (NPDES) storm water permit from Ecology (Industrial Stormwater General Permit No. SO3-005572A). Stormwater Discharge Monitoring Reports (DMRs) describing the results of stormwater monitoring analytical results were submitted to Ecology on a quarterly basis in 2008 in accordance with the Stormwater General Permit and the landfill's Storm Water Pollution Prevention Plan (Shaw, 2005b). TestAmerica, Inc. in Beaverton, Oregon analyzed the stormwater samples.

LFG probes were monitored monthly, the landfill gas collection and control system (GCCS) was monitored twice monthly, and the enclosed LFG flare was monitored at least three times weekly in 2008.

Groundwater, stormwater, and LFG monitoring results for the first, second, and third quarters of 2008 were described in quarterly progress reports (Shaw, 2008a, 2008b, 2008c, respectively) previously submitted to Ecology in 2008. This report presents the fourth quarter 2008 monitoring results.

1.1 Site Description

The LBLF is a closed, 70-acre municipal solid waste landfill located in Clark County, Washington, about 5 miles northeast of Vancouver (see Figure 1-1). The landfill operated from

the late 1930s until 1991. Landfill closure occurred in phases during the summer seasons of 1989, 1990, 1991, and 1992, and included an engineered composite cap, GCCS, and a stormwater control system.

1.2 Hydrogeology

The geology beneath the landfill site includes about 70 to 100 feet of alluvium, underlain by the upper member of the Troutdale Formation. The site hydrogeology consists of an approximately 10-to-40-foot-thick unsaturated (vadose) zone, and an unconfined alluvial water-bearing zone (WBZ), which ranges in thickness from 35 to 45 feet. The alluvium consists of sand, and gravelly to silty sand. Underlying the alluvial WBZ is the upper member of the Troutdale Formation aquifer. The Troutdale Formation aquifer consists of sandy, cobbly gravel with minor amounts of silt and clay. The alluvial WBZ and Troutdale Formation aquifer are separated by a silt aquitard (sandy silt and clayey silt) east and south of the landfill. Southwest of the landfill, the silt aquitard is absent and the two aquifers are locally in hydraulic communication.

1.3 Report Organization

The remainder of this report is organized as follows:

- Section 2.0 presents the 2008 groundwater monitoring activities and analytical results.
- Section 3.0 presents the 2008 stormwater monitoring analytical results.
- Section 4.0 presents the 2008 LFG probe monitoring and describes the replacement activities associated with the LFG flare in 2008.
- Section 5.0 summarizes repair and maintenance activities of the LFG system in 2008.

The report appendices contain the following information:

- Appendix A: Groundwater level data.
- Appendix B: Data quality assurance/quality control review
- Appendix C: Groundwater quality database.
- Appendix D: Summary of groundwater statistical calculations
- Appendix E: Groundwater time-concentration plots.
- Appendix F: Landfill gas probe data.

2.0 Groundwater Monitoring Results

2.1 Groundwater Monitoring Network and Schedule

The groundwater monitoring network consists of monitoring wells screened in the alluvium (alluvial WBZ), the Troutdale Formation aquifer, and at the contact with the base of the alluvium and the top of the Troutdale Formation. The well locations are shown in Figure 2-1. The following describes the monitoring network components.

- Wells monitoring groundwater elevation and quality in the alluvial WBZ are denoted with a "S" in the well number (e.g., well LB-1S)
- Wells monitoring groundwater elevation and quality in the Troutdale Formation aquifer are denoted with a "D" in the well number (e.g., well LB-1D)
- Wells monitoring groundwater at the contact with the base of the alluvium and the top of the Troutdale Formation are denoted with an "I" in the well number (e.g., LB-27I).

Selected site wells were monitored annually or semiannually in 2008 in accordance with the schedule defined in the updated CMP (Shaw, 2005a). During the annual event in March 2008, groundwater samples were collected from the following monitoring wells: LB-1S, LB-1D, LB-3S, LB-3D, B-4SR, LB-4D, LB-5S, LB-5D, LB-6S, LB-10SR, LB-10DR, LB-13I, LB-13D, LB-17I, LB-17D, LB-20S, LB-26I, LB-26D, LB-27I, and LB-27D. During the semiannual monitoring event in September 2008, groundwater samples were collected from the following monitoring wells: LB-1S, LB-5S, LB-6S, LB-10SR, LB-13I, LB-26I, and LB–27I.

Groundwater samples collected from each of the wells in 2008 were analyzed for inorganic parameters including nitrate (as nitrogen), total dissolved solids (TDS), chloride (Cl), dissolved iron, dissolved manganese, and volatile organic compounds (VOCs).

Offsite well LB-14D, located on private property, was formerly used to monitor groundwater elevations through March 2006. After March 2006, access to the property was denied by the property owner. A work plan (Shaw, 2007a) was submitted to and approved by Ecology to decommission the well (approval submitted in an e-mail dated July 25, 2007). However, the property owner was unresponsive to requests by Shaw to schedule the decommissioning activities. Clark County indicated during a Limited Oversight Committee meeting on December 11, 2007, that the County would pursue the matter with the property owner directly. The land owner has remained unresponsive to attempts by the county to attain access to decommission the well and therefore the enforcement for the decommissioning of the well has been turned over to

the Department of Ecology. LBLF is no longer responsible for the decommissioning of offsite well LB-14D.

2.2 Groundwater Levels and Flow Direction

Static water levels measured on March 17 and September 15, 2008, were converted to groundwater elevations and are presented, along with historical groundwater elevation data, in Appendix A. Groundwater potentiometric surface contours depicting horizontal groundwater flow in the alluvial WBZ and the Troutdale Formation aquifer were interpreted using water-level data collected in March and September 2008 (see Figures 2-2 through 2-5). Water levels measured in monitoring wells screened in the alluvium at or near the contact between the alluvium and the Troutdale Formation (designated with a C) were not used for interpreting groundwater flow.

Groundwater flow in the alluvial WBZ is generally towards the west to southwest (see Figures 2-2 and 2-4). Groundwater flow in the Troutdale Formation aquifer is generally southward, varying from southeast to southwest (see Figures 2-3 and 2-5).

Groundwater level hydrographs are provided in Appendix A. The 2008 groundwater elevation data continued to show minor seasonal variations, generally within the range of values measured since 2001 and before 1996. Between 1996 and 1999, water levels measured in the site monitoring wells screened in both the alluvial WBZ and Troutdale Formation aquifer were significantly higher likely in response to increased precipitation.

The differences in water levels in adjacent well pairs screened in the upper-most alluvial WBZ and Troutdale Formation aquifer appear to be influenced by the presence of the silt aquitard (sandy silt and clayey silt). Monitoring well pairs located east and south of the landfill, where the silt aquitard is present, showed the largest difference in water-levels (i.e. at the LB-4 and LB-5 locations). Monitoring well pairs located southwest of the landfill (i.e. LB-1, LB-13 and LB-26 locations), where the silt aquitard is absent, exhibited only small differences in water levels indicating that the two WBZs are locally in hydraulic communication.

2.3 Groundwater Quality Results

2.3.1 Data Quality Review

Field quality assurance and quality control (QA/QC) procedures included collecting duplicate samples, field blank, and carrying trip blanks into the field. Laboratory QA/QC procedures included analyzing surrogate spikes, method blanks, matrix spikes, and matrix spike duplicates. The laboratory QA/QC results are included with the laboratory reports. CAS incorporated its laboratory data quality review comments in the QA/QC narrative of each laboratory report (previously submitted in the first and third quarter reports).

Field and laboratory data and QA/QC procedures were reviewed by Shaw to evaluate whether the data met U.S. Environmental Protection Agency quality control requirements. The results of QA/QC review of the laboratory results are provided in Appendix B. The QA/QC reviews indicated that the data were acceptable for their intended use.

2.3.2 Volatile Organic Compounds

VOCs were not detected in 2008 groundwater samples or QA/QC samples at or above the laboratory method reporting limits, with the exception of the following:

- 2-Butanone (MEK) was detected in a March 2008 groundwater sample collected from well LB-10SR at a concentration of 2,200 micrograms per liter (µg/L). The well was re-sampled in April 2008 and MEK was detected at a concentration of 150 µg/L. During the September 2008, MEK was detected in well LB-10SR at a concentration of 420 µg/L. The recent detections of MEK in samples from well LB-10SR are likely not related to the landfill because (1) MEK has historically not been detected in any site monitoring wells, and (2) MEK was not detected in other monitoring wells located downgradient of and in close proximity to the landfill. These MEK detections are believed to be related to construction activity (new housing development) in the vicinity of well LB-10SR during 2007 and 2008. A Shaw technician had to chip away new concrete around wells LB-10SR and LB-10DR to gain access for sampling in March 2008. The September 2008 MEK concentration shows a substantial decline (approximately 80 percent) compared to the March 2008 data, suggesting that the release of MEK from an unidentified, offsite source was anomalous and likely related to a one-time event. Shaw will continue to monitor this offsite well to evaluate if the MEK concentration in groundwater samples continues to decline.

- Trace concentrations of toluene (0.5, 0.53, 1.8, and 0.62 µg/L) were detected in groundwater samples collected from wells LB-1S, LB-6S, LB-10SR, and LB-26I, respectively[1] during the September 2008 monitoring event. Toluene was also detected in a field blank sample at a concentration of 0.72 µg/L. As stated in the third quarter monitoring report, the toluene detections are anomalous because toluene has historically not been detected in groundwater at the site (VOC detections have historically been related to chlorinated VOCs). Laboratory QC data and inquiries with the laboratory do not indicate that laboratory contamination is the cause of the toluene detections. VOC results for groundwater samples collected during the next quarterly sampling event (first quarter 2009) will be used to confirm the low-level detections of toluene and determine if additional evaluation is warranted.

2.3.3 *Inorganic Parameters*

Summary tables of water quality data are presented in Appendix C. Statistical calculations performed on groundwater data are presented in Appendix D. Time-series concentration plots are presented in Appendix E.

Groundwater quality data collected during the last five years (2004 through 2008) were evaluated for background monitoring wells LB-4SR and LB-4D, and for monitoring wells located near or downgradient of the landfill property (LB-1S, LB-1D, LB-3S, LB-3D, LB-5S, LB-5D, LB-6S, LB-10S/LB-10SR, LB-10D/LB-10DR, LB-13I, LB-17I, LB-17D, LB-20S, LB-26I, LB-26D, LB-27I, and LB-27D), using the statistical method described below. In 2000, the groundwater analyte list was modified; consequently, parameters that were eliminated from the analytical program (laboratory conductance and ammonia) are no longer evaluated statistically (EMCON/OWT, 2000).

Statistical methods consisted of evaluating analyte concentrations to determine if the data show a normal, lognormal, or non-parametric distribution. For normally and log normally distributed data, the 95th percent upper confidence limit (UCL-95) was calculated using the MTCA Stat 97 program[2]. For distributions that were non-parametric, data values were ranked and an estimate of the UCL-95 was determined using the Van der Parren method, as described in Statistical Guidance for Ecology Site Managers (Ecology, 1992). For non-parametric data, the Van der Parren method defaults to the highest reported value.

1 The toluene concentrations are several orders of magnitude below the federal drinking water maximum contaminant level (MCL) of 1,000 µg/L

2The MTCA Stat 97 program was obtained from the Washington Department of Ecology's website: http://www.ecy.wa.gov/programs/tcp/tools/Mtca.exe.

Table 2-1 provides a summary of calculated UCL-95 of the mean values and groundwater compliance levels established in the Consent Decree. Calculated UCL-95 values exceeded compliance levels for nitrate in groundwater sampled from upgradient (background) well LB-4SR. Consistent with historical data, calculated UCL-95 values also exceeded the compliance levels for iron (Fe) and/or manganese (Mn) in groundwater samples from several wells (LB-1S, LB-3S, LB-4SR, LB-5S, LB-10SR). The list of Fe and/or Mn exceedances includes background well LB-4SR and cross-gradient wells LB-3S and LB-5S. Calculated UCL-95 value also exceeded the compliance level for TDS from downgradient well LB-10SR. Shaw believes that the Fe and Mn concentrations in groundwater samples are attributable to natural variations in groundwater chemistry and do not indicate a release from the landfill.

The nitrate concentration (16.6 milligrams per liter [mg/L]) in the March 2007 sample from monitoring well LB-4SR was a historically high concentration, resulting in the UCL-95 exceedance of the compliance level (10 mg/L). The March 2007 nitrate result is anomalous compared to historical concentrations detected in well LB-4SR since 1994, which have been below 10 mg/L. The March 2008 sample from monitoring well LB-4SR was more in line with the long term average (5.4 milligrams per liter [mg/L]). Additionally, nitrate concentrations in samples from wells LB-4D and LB-27D have exhibited increasing trends since the early 1990s. Order of magnitude fluctuations for nitrate observed in upgradient, offsite well LB-4SR, and an apparent increasing nitrate trend in upgradient, offsite well LB-4D, suggest that nitrate concentrations are influenced by upgradient, offsite sources unrelated to the landfill. High nitrate concentrations in the groundwater may be related to residential septic system use in the area. Offsite well LB-10SR also exhibits one of the highest UCL-95 values for nitrate.

The TDS concentration (506 mg/L) in the September 2005 sample from well LB-10SR was a historically high concentration, resulting in the exceedance of the compliance level (500 mg/L). The September 2005 TDS concentration was anomalous compared to historical concentrations, and the compliance level has not been exceeded in any other samples to date.

In addition to the statistical evaluation, time-concentration plots were generated for each of the inorganic parameters tested (see Appendix E)[3]. The time-concentration plots were evaluated visually to assess whether parameter concentrations have increased, decreased or remained stable. Inorganic parameter concentrations in groundwater collected from alluvial WBZ wells (LB-1S, LB-6S, LB-17I, LB-20S, LB-26I and LB-27I) and Troutdale Formation wells (LB-5D, LB-10DR, LB-14D, LB-17D and LB-27D) located hydraulically downgradient of the closed landfill (see Figures 2-2 to 2-5) show either stable or decreasing trends, with the following exceptions.

3 Time concentration plots for the LB-10 series wells (LB-10S and LB-10D) are included until 1999. These wells were not sampled after 1999 because the owner did not grant access. LB-10S and LB-10D were decommissioned in October 2004 and replaced by wells LB-10SR and LB-10DR, respectively.

- Chloride concentrations in groundwater samples from LB-17I exhibited a slight increasing trend since 2000, and chloride concentrations in groundwater samples from LB-20S exhibited a slight increasing trend since 2006; however, 2008 concentrations are significantly below pre-1999 levels.

- Nitrate concentrations in groundwater samples from LB-5D exhibited a slight increasing trend since 2001; however, 2008 concentrations are significantly below the regulatory compliance level.

- TDS concentrations in groundwater samples from LB-27D exhibited a record high for that well in March 2008. The duplicate sample from LB-27D in March 2008 did not confirm the high value, exhibiting a TDS concentration similar to historical concentrations. The high value in the March 2008 sample is still significantly below the regulatory compliance level.

2.4 Groundwater Quality Evaluation

Laboratory analytical results for groundwater samples collected from site monitoring wells in 2008 indicate that groundwater quality is not being affected by the closed landfill as evidenced by the following:

- The concentrations of most inorganic indicator parameters in groundwater samples collected from monitoring wells located downgradient of the former waste cells have either remained generally stable or show decreasing trends.

- UCL-95 exceedances of the compliance level for Fe and/or Mn occur in upgradient and cross-gradient monitoring wells indicate that Fe and Mn concentrations detected in groundwater samples collected from downgradient monitoring wells are representative of naturally occurring concentrations and not related to the landfill.

- VOCs were not detected in groundwater samples collected from the site monitoring wells in 2008, except for an anomalous detection of MEK in an upgradient well, and trace levels of toluene in multiple wells and a field blank. The MEK detection is suspected to be due to nearby construction. MEK was not detected in any downgradient or cross-gradient monitoring wells. The toluene detections are suspected to be due to slight contamination of the equipment used to take the sample, as indicated by the presence of toluene in the field blank.

3.0 Stormwater Monitoring Results

Site stormwater collects in the north detention basin (see Figure 2-1) and is pumped from the north detention basin to a grass-lined ditch that drains to nearby Curtin Creek. The pump(s) are automatically activated to discharge stormwater from the north detention basin depending on the water level in the basin.

Stormwater discharge samples are collected at the point of discharge quarterly. Stormwater samples were collected on January 15, May 13, and October 31, 2008. In the third quarter (July, August and September) 2008, there was only one qualifying rain event; Shaw personnel were not available to sample the stormwater from this event. In accordance with the landfill's General Stormwater Permit, the stormwater samples were analyzed for the following parameters: turbidity, pH, oil and grease, biological oxygen demand, total suspended solids, ammonia, alpha terpineol, benzoic acid, p-cresol, phenol, and total zinc.

Stormwater DMRs describing the results of stormwater analytical results were submitted to Ecology on a quarterly basis in accordance with the General Permit. The first, second, and third quarter stormwater monitoring results were also described in the first, second, and third quarter progress reports (Shaw, 2008a, 2008b, and 2008c, respectively), previously submitted to Ecology.

The analytical results of stormwater samples collected in 2008 indicate that stormwater quality benchmarks for the parameters listed above were not exceeded.

4.0 Landfill Gas Monitoring Results

4.1 LFG Probe Monitoring

LFG probes were monitored monthly in 2008. The locations of the LFG probes are shown in Figure 4-1. Probes constructed as dual-completion are designated with an "A" for the shallow probe and "B" for the deep probe. Shallow and deep probes that are installed in separate borings are identified with "S" and "D", respectively. Parameters measured at each probe include LFG composition (percent methane, carbon dioxide, oxygen and balance gas [assumed to be nitrogen]) and static pressure. The 2008 probe monitoring results are attached in Appendix F.

During 2008, the LFG probes were in compliance with the Minimum Functional Standards (MFS) (Chapter 173-304 WAC) requirement that methane concentrations shall not exceed 5 percent methane by volume along the site property boundary. Periodic concentrations exceeding 5 percent by volume were measured at probes GP-6, GP-7, and GP-8. However, these probes are not located along the site's point of compliance; rather, they are located in the northwest closure area (Module 1) near the edge of the waste limits. Methane concentrations in these probes have historically shown periodic elevated LFG concentrations (i.e., above 5 percent methane) due to their proximity to the waste limits, the shallow depth of the waste in this area, and a relatively shallow water table that inhibits the GCCS collection efficiency in this area. Whenever methane concentrations in LFG probes GP-6, GP-7, or GP-8 exceed 5 percent by volume, the nearby LFG extractions wells are adjusted to increase the vacuum in the area, and the probes are re-monitored at least weekly until the methane concentrations at the probe(s) decrease below 5 percent by volume. The following is a summary of the monitoring events performed during 2008 in which methane concentrations were measured at or above 5 percent by volume at LFG probes GP-6, GP-7, and GP-8:

- GP-6 methane concentrations measured in March (12.9%), May (7.5%), and December (10.9%).
- GP-7 methane concentrations measured in March (7.8%).
- GP-8 methane concentrations measured in January (8.3%), March (15.6%), and May (11.7%).

Historical remonitoring at LFG probes GP-6, GP-7, and GP-8 generally show that methane concentrations decline to below the compliance threshold within several days to a week following adjustments to the adjacent LFG extraction wells. However, methane concentrations measured at probe GP-8 persisted intermittently above 5 percent, by volume, during the first half of 2008, but were below 5 percent for the remainder of the year.

Positive static pressures were not measured at probes GP-6, GP-7, and GP-8 during instances when the methane concentrations exceeded 5 percent, by volume. The lack of positive static gas pressures at the higher methane concentrations is indicative of a very low rate of biological decomposition near the probe locations which is consistent with other municipal solid waste landfills of this age. The lack of positive pressure also suggests the subsurface methane plume is likely not being driven laterally over any sizable distance from the edge of the waste limits.

4.2 LFG Flare Replacement and Monitoring

A landfill's rate of LFG generation typically peaks within 1 to 2 years following the stoppage of waste acceptance, and then continually decreases with time. A number of years ago, one of the two original enclosed flare systems installed during site closure was removed from service due to the age of the landfill and its decreasing LFG quantities. All of the extracted LFG was then routed to the remaining south flare system. Due to the continued drop off in LFG generation, the south flare system has also since become oversized for the quantities of LFG being generated. In 2006, the LBLRC decided to replace the former flare with a smaller, enclosed flare system.

On March 16, 2007, a new, smaller-capacity enclosed flare was brought on-line. In coordination with Southwest Clean Air Agency (SWCAA), Shaw conducted a flare emission source test on May 15, 2007. Results of the test determined the flare was operating within specified emissions limits required under SWCAA Air Discharge Permit (ADP) 07-2714, issued February 15, 2007. A source evaluation report summarizing the test results was submitted to SWCAA on June 28, 2007 (Shaw, 2007b).

The LFG flare system was monitored regularly in 2008. The monitored parameters include LFG composition, static pressure, flow rate, and temperature measured at the flare inlet. In addition, the flare operating temperature is also measured and recorded. The flare system is equipped with a continuous monitoring system which measures and records the flare operating temperature, inlet LFG flow rate, and inlet LFG oxygen concentration. The data is stored onto a memory card which is periodically replaced and the data downloaded onto a portable computer for recordkeeping. In accordance with SWCAA requirements, an Annual Emissions Estimate report documenting the flare monitoring data is submitted to the SWCAA in accordance with the conditions under Appendix A, Section 3, Monitoring/Record Keeping Requirements, Item 3c, of Order of Approval SWCAA 94-1637.

5.0 Landfill Maintenance

The landfill was inspected monthly during 2008 to check for maintenance items or unusual conditions. Repair and maintenance activities for the first, second, and third quarters in 2008 were documented in quarterly progress reports (Shaw, 2008a, 2008b, and 2008c, respectively) previously submitted to Ecology. The repair and maintenance activities performed in 2008, including the fourth quarter activities, are summarized in the following sections.

5.1 First Quarter 2008

5.1.1 January

- Replaced controller at condensate traps CT-S3, CT-S4, CT-S5, and CT-S7.
- Poured concrete for the supporting flare data controller weather structure.
- Reduced flow at flare, and adjusted the flare louvers to lower opening (38 percent open).
- Constructed a protective cover over the flare control panel.

5.1.2 February

- Shaw's technician met onsite with a Southwest Clean Air Agency representative for annual inspection, to view flare, and answer questions.
- An employee from the adjacent recycling center requested a Shaw technician to install one of their locks on a gate to allow them access to an area for grass mowing purposes. Shaw's technician approved this request.
- Plumbed a ¼-inch gas sampling line from the flare system header to the control shack for monitoring purposes.
- Emerald Recycling pumped approximately 2,000 gallons of condensate from the storage tank and hauled condensate to a treatment facility.
- Overhauled flare blower No. 2 and reinstalled the blower.
- Repaired two holes cut in fence near gas probe GP-13.
- Initiated coordination with Olsen Engineering for site surveying services (for western access gate modifications and south perimeter fence line).

5.1.3 March

- Only routine maintenance and repair activities were performed in March 2008

5.2 Second Quarter 2008

5.2.1 April

- Performed routine maintenance of the GCCS, including the LFG extraction wells and piping.
- Performed routine maintenance of the condensate collection system, including the condensate sumps, airlines, discharge lines, and compressors.
- Performed routine site and flare checks.
- Replaced the LFG flare controller data card.
- Repaired hole in fence near GP-22.
- Coordinated with Emerald Recycling to pump out condensate tank and haul recovered condensate to a treatment facility.
- Repaired a hole in the fence and posted a "No Trespassing" sign.

5.2.2 May

- Performed routine maintenance of the GCCS, including the LFG extraction wells and piping.
- Performed routine maintenance of the condensate collection system, including the condensate sumps, airlines, discharge lines, and compressors.
- Performed routine site and flare checks.
- Met with security contractor onsite to enable cost estimation for site patrols.
- Found and repaired several air leaks in the system at flex hoses.
- Repaired several labcock valves to facilitate monitoring.
- Repaired hole in fence near GP-26/GP-27.

5.2.3 June

- Performed routine maintenance of the GCCS, including the LFG extraction wells and piping.
- Performed routine maintenance of the condensate collection system, including the condensate sumps, airlines, discharge lines, and compressors.
- Performed routine site and flare checks.
- Repaired fence near SW-12.
- Clipped overhanging branches along the perimeter of site access road.

- Evaluated future fencing project at Koski property.
- Changed compressor oil.
- Recycled old flare access ladder
- Met with fencing contractor onsite for cost estimating of property fencing requirements.

5.3 Third Quarter 2008

5.3.1 July

- Pumped condensate from the sump into the holding tank.
- Transferred compressor blow-off wastewater to the wastewater (condensate) holding tank.
- Reset the air dryer after a fault occurred due to higher temperature in the compressor shed.
- Conducted pre-bid site meetings with several fencing contractors to install new fencing and an entrance gate.
- Met with Metro Watch, Inc. to discuss the initiation of site security patrols.
- Removed vegetation along south property line of adjacent Koski property.

5.3.2 August

- Reset air dryer and adjusted thermocouples.
- Evaluated alternatives for repair of emergency dirt road access (road is currently not used).
- Repaired small sections of fencing on west perimeter fence line and near GP-22.
- Provided oversight of fence installation activities at the Koski property. After final inspection of the fence, contacted the fencing contractor (New Hudson Fence) to schedule adjustments.

5.3.3 September

- Met with several excavating contractors for pre-bid site visits to observe emergency dirt road access. Bids are being obtained to regrade the road.
- Facilitated obtaining access to the landfill for Metro Watch, Inc. from Waste Connections through its facility.

5.4 Fourth Quarter 2008

5.4.1 October

- Performed routine maintenance on the GCCS wells, piping, and flare station.
- Performed routine maintenance on the LFG condensate collection system, including the condensate sumps, airlines, discharge lines, compressors, etc.
- As requested by Clark County, met with North Sky Communications fiber optics contractor working on cables near the north pond to assist with site access. Notified contractor to avoid damaging pond liner. Observed contractor using pulley system with rope to pull fiber optics line materials across the pond.
- Pumped compressor condensate tank and changed compressor oil.

5.4.2 November

- Performed routine maintenance on the GCCS wells, piping, and flare station.
- Performed routine maintenance on the LFG condensate collection system, including the condensate sumps, airlines, discharge lines, compressors, etc.
- Repaired air leaks in the LFG collection piping system.
- Transferred 800 gallons of condensate from primary to secondary storage.
- Repaired a main GCCS line between NW-1 and NE-1
- Installed two rebuilt pulse pump controllers

5.4.3 December

- Performed routine maintenance on the GCCS wells, piping, and flare station.
- Performed routine maintenance on the LFG condensate collection system, including the condensate sumps, airlines, discharge lines, compressors, etc.
- Repaired air leaks in the LFG collection piping system.
- Installed new controllers in S-4 and S-7; old controllers sent in for repair.
- Emerald Services pumped 1,660 gallons of condensate with Shaw oversight and hauled condensate to a treatment facility.
- Replaced actuator for air refrigerator; the refrigerator was not bleeding off moisture.
- Based on previous problems with security services, Shaw met with Metro Watch Security Services, including President/CEO Al Garcia and VP/COO Mike Zocchi to discussed driving routes, entrances and exits, relative landmarks, and Shaw's expectations of their security services.

- Repaired 6" coupler that was broken due to cold weather conditions.

6.0 References

EMCON/OWT, Inc. 2000. Letter (re: water quality monitoring reduction at Leichner Landfill) to Rebecca Lawson, Washington Department of Ecology, Olympia, Washington, by EMCON/OWT, Inc., Portland, Oregon. March 30.

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Limitations

The services described in this report were performed consistent with generally accepted professional consulting principles and practices. No other warranty, expressed or implied, is made. These services were performed consistent with our agreement with our client. This report is solely for the use and information of our client unless otherwise noted. Any reliance on this report by a third party is at such party's sole risk.

Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of separated portions of this report.

Table

Table 3-1
Statistical Summary of Groundwater Quality Data
95 Percent Upper Confidence Limit of the Mean
Leichner Landfill

Parameter	Compliance Level	Units	LB-1S	LB-1D	LB-3S	LB-3D	LB-4SR	LB-4D	LB-5S	LB-5D	LB-6S	LB-10S[a] (LB-10SR)
Inorganic Parameters												
Chloride	250	mg/L	M(8.9)	M(6.7)	M(2.8)	M(3.3)	12.71	M(2.7)	5.27	M(18.0)	14.61	M(14.3)
Nitrate	10	mg/L	5.71	5.82	3.60	M(4.4)	**21.48**	7.06	5.95	M(1.1)	3.52	8.30
Total Dissolved Solids	500	mg/L	229.74	237.27	M(163)	M(169)	234.91	150.68	213.48	359.48	M(328)	**581.07**
Metals												
Iron (dissolved)	0.3	mg/L	**M(1.62)**	M(0.07)	**M(4.59)**	All ND	**M(0.439)**	All ND	**10.17**	M(0.08)	M(0.30)	**M(1.04)**
Manganese (dissolved)	0.05	mg/L	**M(0.203)**	M(0.006)	**M(0.07)**	All ND	M(0.040)	All ND	**M(0.407)**	All ND	M(.037)	**M(2.05)**
Volatile Organic Compounds												
1,1-Dichloroethene	0.1	µg/L	All ND	All ND	All ND	All ND	All ND	All ND	All ND	All ND	All ND	All ND
1,4-Dichlorobenzene	1.8	µg/L	All ND	All ND	All ND	All ND	All ND	All ND	All ND	All ND	All ND	All ND
Tetrachloroethene (PCE)	5	µg/L	All ND	All ND	All ND	All ND	All ND	All ND	All ND	All ND	All ND	All ND
Trichloroethene (TCE)	5	µg/L	All ND	All ND	All ND	All ND	All ND	All ND	All ND	All ND	All ND	All ND
Vinyl Chloride	0.1	µg/L	All ND	All ND	All ND	All ND	All ND	All ND	All ND	All ND	All ND	All ND

Table 3-1
Statistical Summary of Groundwater Quality Data
95 Percent Upper Confidence Limit of the Mean
Leichner Landfill

Parameter	Compliance Level	Units	LB-10D[a] (LB-10DR)	LB-13I	LB-13D	LB-17I	LB-17D	LB-20S	LB-26I	LB-26D	LB-27I	LB-27D
Inorganic Parameters												
Chloride	250	mg/L	32.28	9.19	4.1	26.1	M(11.0)	12.57	10.17	4.5	21.9	13.74
Nitrate	10	mg/L	0.97	5.11	5.3	M(0.2)	All ND	M(0.2)	M(5.6)	5.5	4.7	M(3.4)
Total Dissolved Solids	500	mg/L	**563.07**	273.16	M(190)	377.3	284.65	435.81	230.65	202.3	371.8	M(364)
Metals												
Iron (dissolved)	0.3	mg/L	**M(1.03)**	M(0.09)	M(0.02)	**13.3**	0.11	**1.02**	All ND	All ND	M(0.04)	All ND
Manganese (dissolved)	0.05	mg/L	**1.55**	M(0.028)	M(0.005)	**1.9**	**4.14**	**2.64**	M(0.011)	All ND	**M(0.530)**	**M(0.285)**
Volatile Organic Compounds												
1,1-Dichloroethene	0.1	µg/L	All ND	All ND	All ND	All ND	All ND	All ND	All ND	All ND	All ND	All ND
1,4-Dichlorobenzene	1.8	µg/L	All ND	All ND	All ND	All ND	All ND	All ND	All ND	All ND	All ND	All ND
Tetrachloroethene (PCE)	5	µg/L	All ND	All ND	All ND	All ND	All ND	All ND	All ND	All ND	All ND	All ND
Trichloroethene (TCE)	5	µg/L	All ND	All ND	All ND	All ND	All ND	All ND	All ND	All ND	All ND	All ND
Vinyl Chloride	0.1	µg/L	All ND	All ND	All ND	All ND	All ND	All ND	All ND	All ND	All ND	All ND

NOTE: Data evaluated for the last five years, unless noted. mg/L = milligrams per liter. µg/L = micrograms per liter.

Values shown are the 95 percent upper confidence limit on the mean (UCL95) calculated using MTCAStat 97 program and Statistical Guidance for Ecology Site Managers.

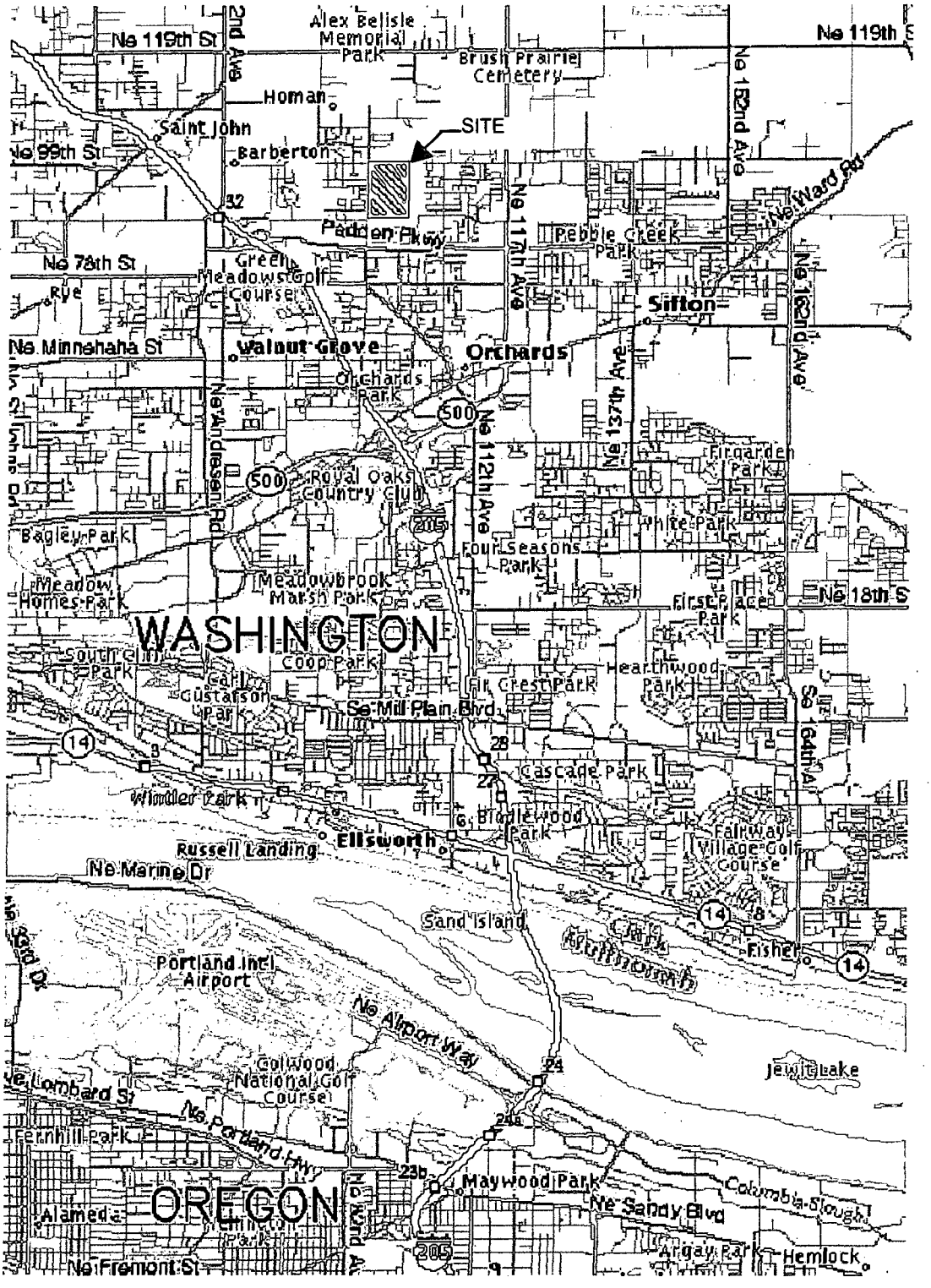
ND = indicates not detected at any sampling event.

M represents maximum value detected in last five years shown in parenthesis.

Values shown in **bold** are greater than the specified compliance level.

[a]Wells LB-10S and LB-10D were decommissioned October 7, 2004 and replaced by LB-10SR and LB-10DR in October 2004. Data from March 2005.

Figures



NOTE:
NOT TO SCALE

Shaw° ENVIRONMENTAL, Inc.

DATE 1/30/08
DWN JC
APP
REV
PROJECT NO.
125544

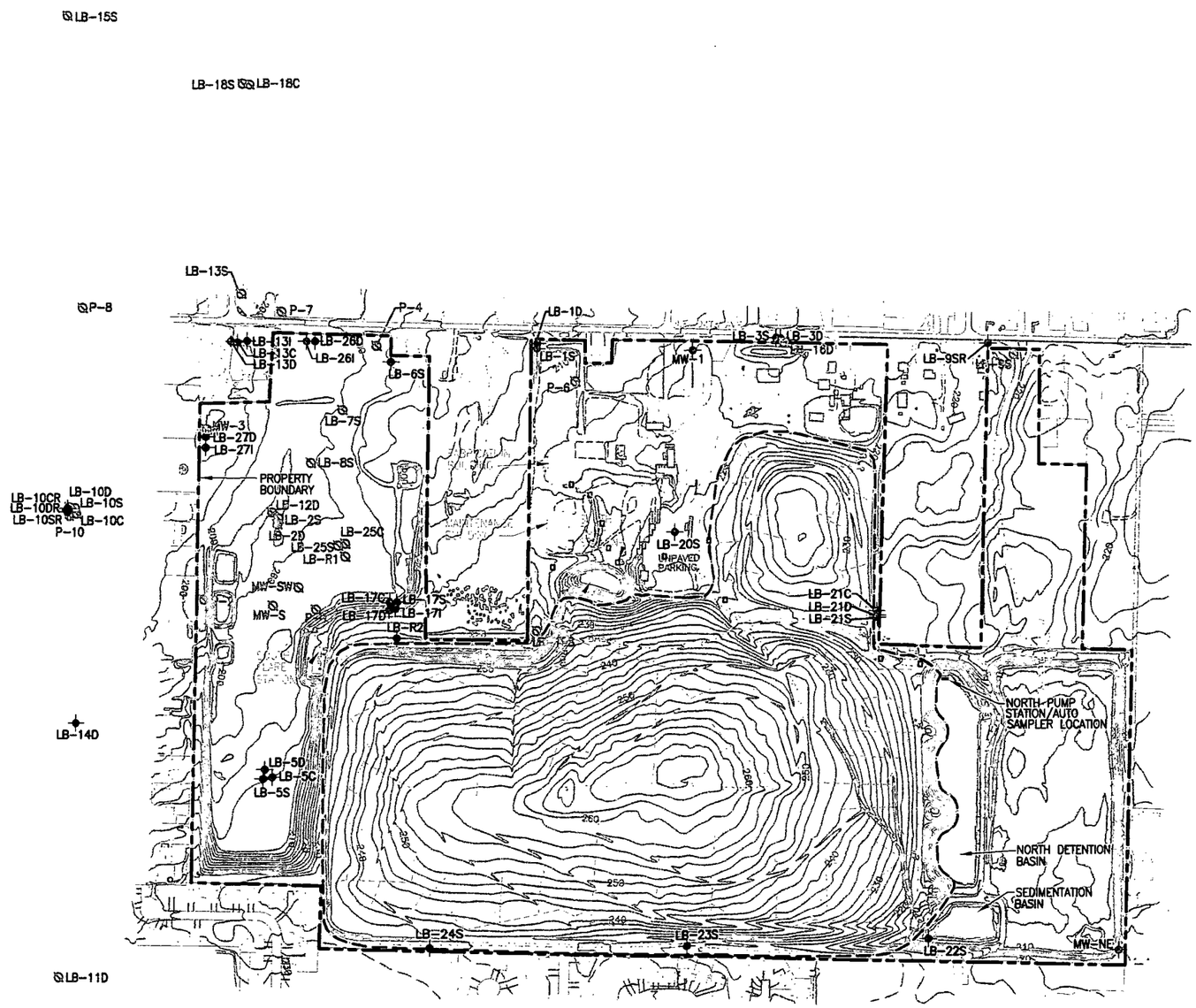
FIGURE 1-1

LEICHNER BROTHERS LANDFILL
CLARK COUNTY, WASHINGTON

SITE LOCATION MAP

1" 1/2" 0"
Feb 18, 2009 - 9:44am
N:\Cad\Drawings\Leichner Brothers LRC\Hydrogeology\2007 AEMR\Figure 1-1.dwg

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
PORTLAND	JC 2/2009	AT 2/09		BT-125544-B1



LEGEND:

- LB-13S,I,C ✦ Well Location, Alluvial Aquifer
- LB-13D ◆ Well Location, Troutdale Aquifer
- P-8 ⊠ Abandoned Well or Piezometer
- ——— Property Boundary
- – – – – Limit of Landfill Cover and Approximate Edge of Waste
- ▫ Catch Basin

0 500 1000

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Portland, Oregon 97223
Phone (503) 603-1000
Fax. (503) 603-1001

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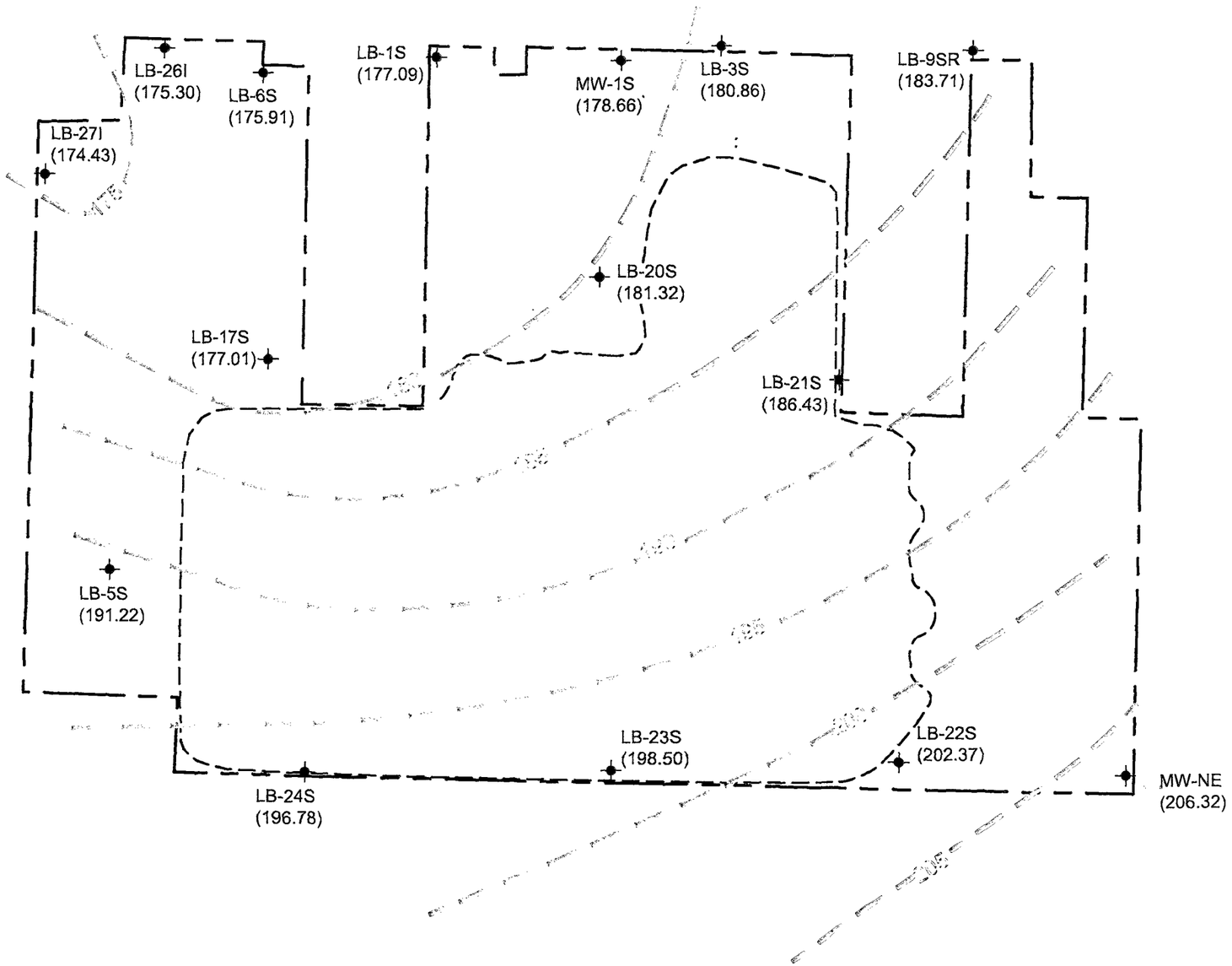
FIGURE 2-1

GROUNDWATER MONITORING LOCATIONS

LEICHNER LANDFILL
CLARK COUNTY, WASHINGTON

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
PORTLAND	MPortacio 2/2009	AT 2/09		BT-125544-B1



EXPLANATION:

LB-13S,I ✦ Well Location, Alluvial Water–bearing Zone

Property Boundary

Limit of Landfill Cover and Approximate Edge of Waste

Groundwater Potentiometric Surface Contours

(206.32) Groundwater Elevation (March 17, 2008)

N

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FIGURE 2-2
GROUNDWATER POTENTIOMETRIC SURFACE CONTOURS
ALLUVIAL WATER - BEARING ZONE
MARCH 17, 2008
LEICHNER LANDFILL
CLARK COUNTY, WASHINGTON

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
PORTLAND	MPontacio 2/2009	AT 2/09		BT-125544-B2

LB-13D (174.63)
LB-26D (176.05)
LB-1D (174.29)
LB-3D (180.00)
LB-27D (167.65)
LB-10DR (160.99)
LB-17D (176.13)
LB-21D (183.45)
LB-14D (NA)
LB-5D (170.58)
LB-4D (173.13)

175
165
170
175
180

EXPLANATION:

- LB-13S,I ✦ Well Location, Troutdale Aquifer
- Property Boundary
- Limit of Landfill Cover and Approximate Edge of Waste
- Groundwater Potentiometric Surface Contours
- (173.13) Groundwater Elevation (March 17, 2008)
- (NA) Well Not Accessible

N

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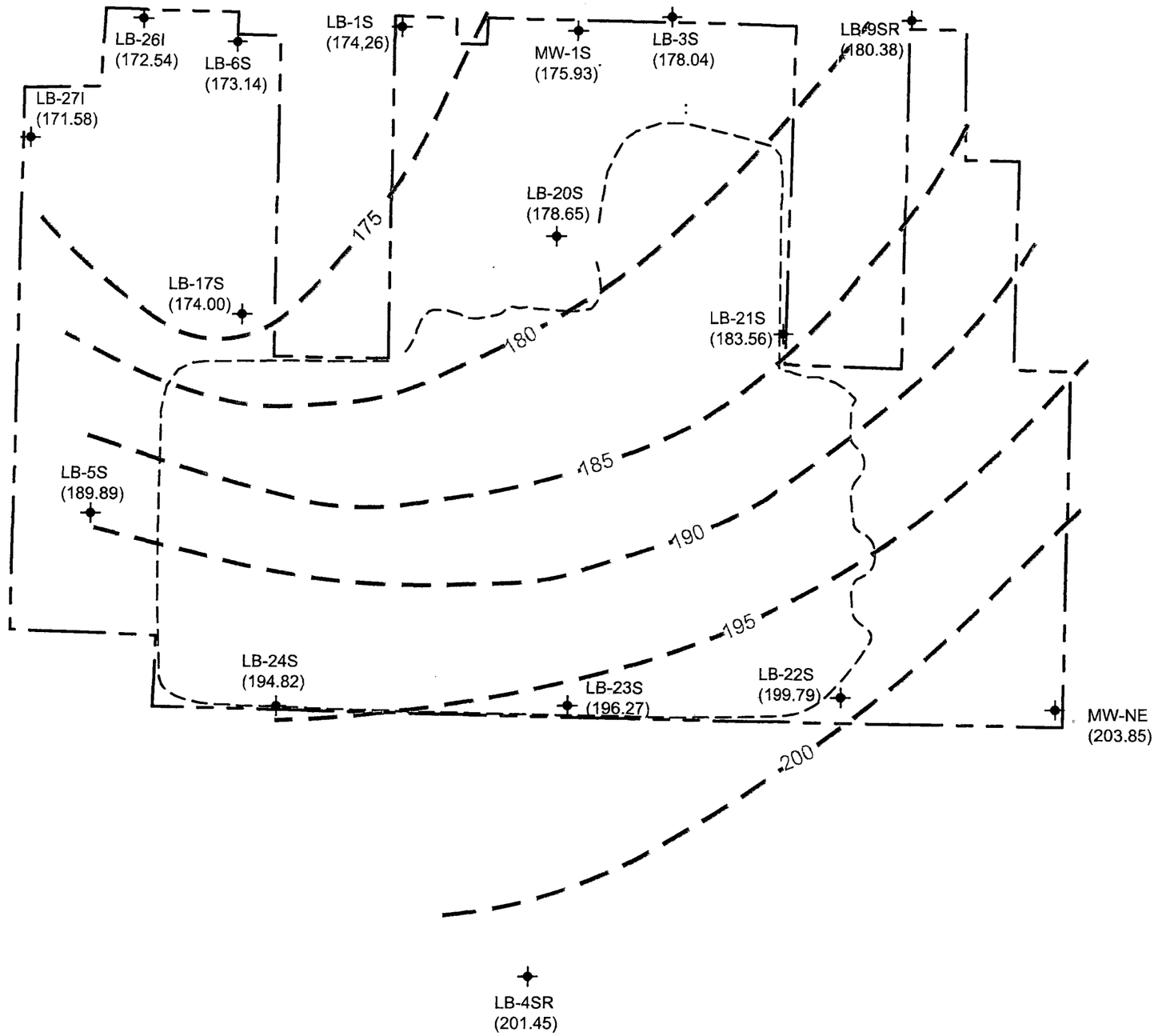
FIGURE 2-3
GROUNDWATER POTENTIOMETRIC SURFACE CONTOURS TROUTDALE AQUIFER MARCH 17, 2008
LEICHNER LANDFILL

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
PORTLAND	MPortacio 2/2009	AT 2/09		BT-125544-B3



EXPLANATION:

LB-13S,I ✦ Well Location, Alluvial Water–bearing Zone

Property Boundary

Limit of Landfill Cover and Approximate Edge of Waste

Groundwater Potentiometric Surface Contours

(201.45) Groundwater Elevation (September 15, 2008)

N

SCALE

0 400 800 FEET

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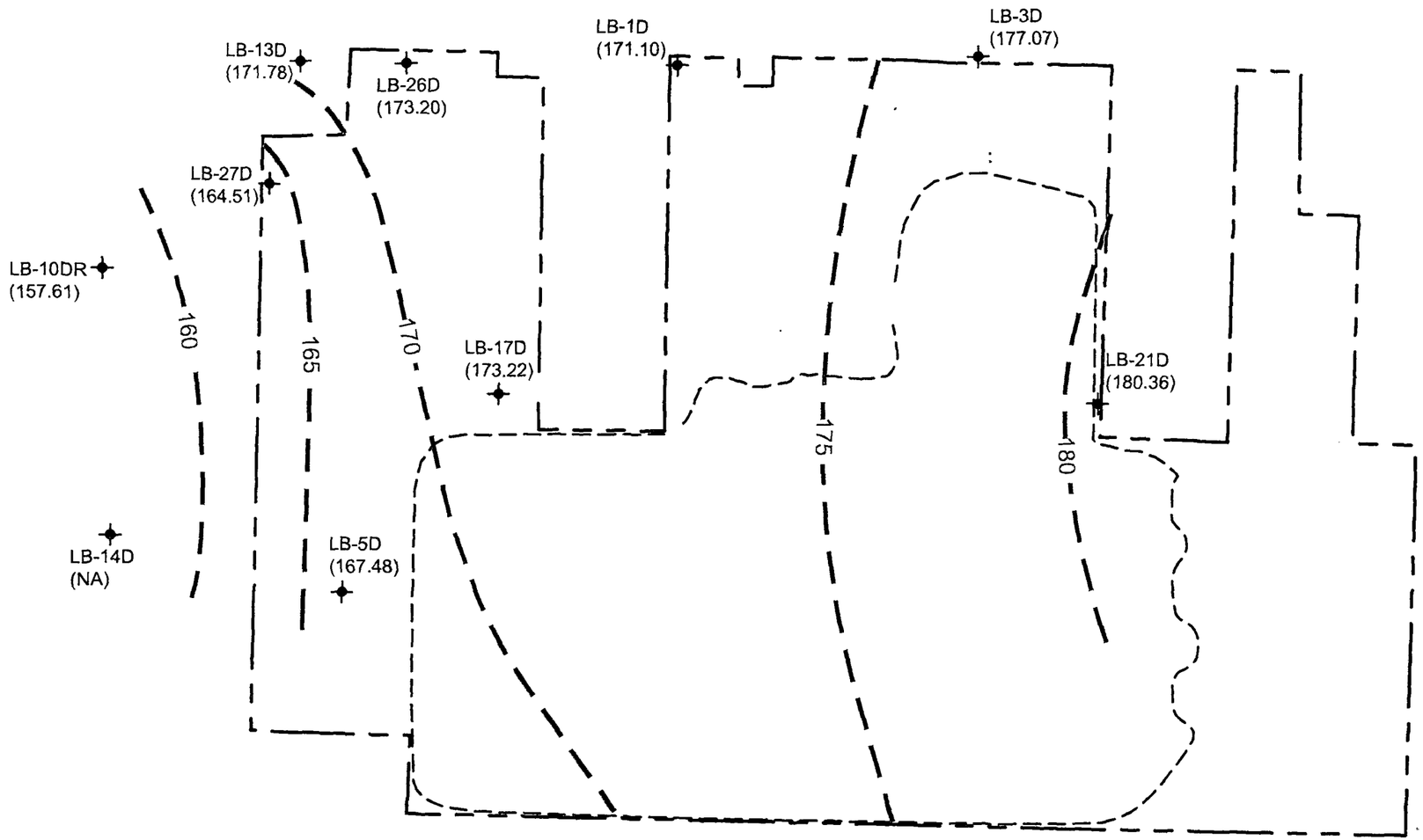
FIGURE 2-4

GROUNDWATER POTENTIOMETRIC SURFACE CONTOURS ALLUVIAL WATER - BEARING ZONE SEPTEMBER 15, 2008

LEICHNER LANDFILL
CLARK COUNTY, WASHINGTON

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
PORTLAND	MPortacio 2/2009	AT 2/09		BT-125544-B4



EXPLANATION:

- LB-13S,I ✦ Well Location, Troutdale Aquifer
- Property Boundary
- Limit of Landfill Cover and Approximate Edge of Waste
- Groundwater Potentiometric Surface Contours
- (169.43) Groundwater Elevation (September 15, 2008)
- (NA) Well Not Accessible

SCALE
0 400 800 FEET

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FIGURE 2-5
GROUNDWATER POTENTIOMETRIC SURFACE CONTOURS
TROUTDALE AQUIFER
SEPTEMBER 15, 2008
LEICHNER LANDFILL
CLARK COUNTY, WASHINGTON

E 12000
E 12500
E 13000
E 13500
E 14000
N 10000
N 10500
N 11000
N 11500
N 12000

GATE
PROPERTY BOUNDARY
FABRICATION BUILDING
MAINTENANCE BUILDING
SOUTH PUMP STATION
WEST DRAINAGE BASIN
SOUTH FLARE STATION
NORTH PUMP STATION/ AUTO SAMPLER LOCATION
NORTH DETENTION BASIN
SEDIMENTATION BASIN

GP-1A GP-1B
GP-2
GP-3
GP-4A GP-4B
GP-5
GP-6
GP-7
GP-8
GP-9A GP-9B
GP-10A GP-10B
GP-11
GP-12
GP-13
GP-14
GP-14R
GP-15
GP-16D
GP-16S
GP-17D
GP-17S
GP-18D
GP-18S
GP-19D
GP-19S
GP-20
GP-21A GP-21B
GP-22
GP-23
GP-24A GP-24B
GP-25A GP-25B
GP-26
GP-27
GP-28
GP-29
GP-30A GP-30B
GP-31
GP-32
GP-33
GP-34
GP-35
GP-36
GP-37
GP-38

LEGEND:

- GP-1 ◆ Gas Probe Location
- GP-14 ⊗ Decommissioned Gas Probe Location
- ○ Vertical Gas Well
- ▲ Condensate Sump
- ------ Gas Collection Piping
- ———— Property Boundary

Shaw° EMCON/OWT, Inc.

0 300 600
SCALE (FEET)

DATE 1/30/08
DWN JC
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REV
PROJECT NO. 125544

FIGURE 4-1
LEICHNER LANDFILL
CLARK COUNTY, WASHINGTON

LANDFILL GAS PROBE LOCATIONS